

**FY2004 Task 5, Final Report:
Summary of Findings and Recommendations to the FAA**

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**This effort is the final deliverable under the FITS Program FY2004 Task 5:
*Development of a methodology to justify the inclusion or removal of maneuvers from
flight training curriculums.***

INTRODUCTION

This is the final report and the culmination of research completed by the FITS team to develop improved methodology for inclusion or deletion of maneuvers to the Practical Test Standards (PTS). Three previous reports have been submitted:

Report #1 explained the current methodology used by the FAA to add or remove tasks from the PTS. FITS research concluded that current FAA methodology, though generally accepted for many years, has not been updated to include modern scientific or statistical methods to select training and evaluation tasks. In addition, the FAA currently solicits proposals for PTS change from a rather narrow band of subject matter experts—primarily employees of the FAA or NTSB. No major effort is made beyond this group—except for a single statement in the introduction section of each PTS that says, “Comments regarding this publication should be sent to: Federal Aviation Administration (address).

Report #2 was the FITS team’s initial proposal for an improved PTS methodology. A Job Analysis approach was selected because it incorporates modern philosophy and research protocols regarding curriculum development and human performance evaluation. In addition, it allows for statistical measurement of training validity and allows for input from a broad spectrum of subject matter experts.

Report #3 explained the results of a FITS test to evaluate the improved methodology described in Report #2. Report 3 included analysis of data collected via surveys that were distributed to Certified Flight Instructors in CFR Part 141 flight schools.

The purpose of this final report is to blend the findings of the previous three reports to provide a final, improved recommendation.

FINDINGS

1. Many of the maneuvers currently included in the Practical Test Standards were originated by the Army Air Corp (pre-1947) and later adapted by the FAA for general aviation. There has never been any scientific evaluation of these maneuvers to determine validity.
2. It is widely accepted within the flight training and aviation education community that test items (in this case, the individual maneuvers) included as part of a test or evaluation should be both *content valid* and *criterion valid*. Content validity means that a particular maneuver closely mimics a maneuver required in actual flight. Criterion validity means that the completion standards for the test are reflective of acceptable standards in actual flight. In Report #3, ratings collected from surveys distributed to flight instructors indicated that a number of PTS maneuvers (eights on pylon, chandelles, lazy eights, s-turns, etc) do not represent actual flight maneuvers and therefore are not content valid. In addition, a handful of maneuvers also seem to lack criterion validity (180 degree accuracy approach and landing, steep spiral, lazy eights, eights on pylon, and chandelles). An exact test of criterion validity, however, was not accomplished.

3. Redundancy of testing is another issue. If a particular skill is sufficiently tested in one maneuver, it need not be evaluated in other maneuvers. Once again, Report #3 identified a group of maneuvers that exhibited excessive redundancy, specifically: 180-degree accuracy approach and landing, chandelles, lazy eights, eights on pylons, s-turns, turns around a point, steep spirals, and rectangular course.

4. If a particular evaluation maneuver is artificial (i.e. it does not mimic a maneuver required in actual flight; low content validity), and if the skills that are evaluated by that maneuver are sufficiently tested by other maneuvers, especially if the other maneuvers are more realistic of actual flight (high criterion validity and high content validity), then the artificial maneuvers could be eliminated—especially if training time or cost is critical.

5. Report #3 also demonstrated how pilot surveys can be used to apply a numerical rating to individual training tasks or maneuvers. Numerical ratings provide statistical evidence of maneuver validity—evidence that can subsequently be used to eliminate (or add) maneuvers when necessity dictates.

6. Research conducted at Middle Tennessee State University in conjunction with the NASA Langley Research Center supports the aforementioned FITS findings. Students trained at MTSU using scenario based training methods demonstrated stick-and-rudder skills equal to or better than students trained under the maneuver based approach. Of even more significance, however, is that the same data also suggests that FITS trained students demonstrate better decision making skills than maneuver based students—most likely because their training occurred while performing realistic flight maneuvers and not artificial maneuvers designed only for the test.

7. Research conducted at Embry-Riddle Aeronautical University also supports the aforementioned findings. In this particular research study, maneuver based trained participants were compared to FITS trained (which incorporates scenario-based training) participants. The data collected indicates that scenario based training may lead to improved piloting and navigation skills over traditional maneuvers based training techniques. The FITS trained participants demonstrated the same skills and knowledge as the maneuver based trained participants, but the maneuvers were practiced in the context of a scenario. Many scenarios were coupled to the maneuver until the student had not only the requisite skills but related them to many conditions where they would be needed. The data also supports that when a condition occurs requiring a maneuver, the FITS trained participant responded correctly and faster than the maneuver based trained participant, who must search their memory to link a maneuver to a situation.

FITS RECOMMENDATION

1. The FAA should consider eliminating tasks that are unrealistic for actual flight (i.e., low content and low criterion validity with actual flight) from the PTS evaluation. This includes most of the ground reference maneuvers (rectangular course, turns around a point, and s-turns) and a majority of the commercial maneuvers (180-degree accuracy approach and landing, chandelles, lazy eights, eights on pylons, and steep spirals). In addition to being unrealistic for actual flight, the completion standards for these maneuvers seem artificial, and survey respondents indicated that the skills they evaluate are sufficiently evaluated in other tasks.
2. Instructors should have the prerogative to choose whatever maneuver they deem appropriate to teach necessary pilot skills—including the maneuvers FITS has recommended for elimination from the PTS. The FAA should not be concerned with how a skill is developed, only whether or not a pilot has acquired it.
3. Use the Job analysis survey approach to update the PTS. That is, if a new item is suggested, break it down into knowledge and skills, and have a representative sample of subject matter experts rate the importance of the knowledge and skills. This could be done via on-line surveys distributed to a broad cross section of general aviation subject matter experts (SME's). FAA employees, examiners, and certified flight instructors should all be included in this distribution. Surveys should solicit feedback similar to the FITS PTS survey, which will then provide statistical data to justify PTS changes. This data will be considered, along with other inputs currently in use, to make proposals for a PTS change.
4. Additional research is also recommended.
 - a. Assess FAA examiners and Master Instructors views (i.e. give them the survey). Compare the results obtained from these two additional populations to the current results.
 - b. Conduct a survey to evaluate how much time instructors spend training ground reference maneuvers, such as Pylon Eights. Anecdotal flight instructor comments have indicated that an inordinate amount of time is required—compared to training value.
 - c. Complete a more detailed task analysis of the PTS. Disagreements exist regarding what skills and knowledge are needed for each maneuver. A detailed job analysis would resolve this issue.
 - d. Conduct an actual test of criterion validity. This would require a study comparing pilots' performance in actual flight (neither a training situation nor a testing situation) with their performance on individual items on the PTS.